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Biocoenological studies on the invasion with *Oesophagostomum dentatum* Rudolphi 1803 in domestic swine and wild boars

Biocenologiczne studia nad inwazją *Oesophagostomum dentatum*
Rudolphi 1803 u świń domowych i dzików

The acquaintance with the regularity controlling the host-parasite relationship can be of great importance above all in the understanding of the pathogenesis of parasitic diseases and, in consequence, of their clinical conditions, and of therapy as well.

We know that an invasion is very often a normal and permanent phenomenon in natural conditions, but a parasitic disease is an abnormal state. However, not every invasion, not always and not in every condition leads to the outbreak of a disease. The answer to the question concerning the condition of the outbreak of a parasitic disease is to be found among others just in the quantitative relations and in the population structure of parasites.

The above-mentioned considerations had influenced the author when starting with the work on that problem. The nematode *Oesophagostomum dentatum* Rudolphi 1803 was chosen as the material for the present study because of its common occurrence in swine. The extensiveness of invasion with that nematode in domestic swine, always very high, fluctuates in different countries within relatively narrow limits from 70 — 100%. In Poland 70.52% of swine have been affected by that invasion.

Oe. dentatum can also be found in wild boars and the extensiveness of invasion in those free-living hosts in Poland hardly reaches 13.14% (Tarczyński 1956). It is thus a parasite by means of which we can investigate the existence of possible differences in the course of invasion depending on the living conditions of the host, and we can settle the effects of host domestication on the structure of the parasite population.

The choice of the object of this investigation was also influenced by the fact that, although oesophagostomosis passes in swine subclinically, in the majority of cases *Oe. dentatum* is responsible for the 10 — 60% reduction of weight increase in swine in the case of more intensive invasions.

Taking into consideration the economical significance of that nematode, many authors have chosen it as the object of various investigations. We are indebted to them for the fairly detailed data concerning its morphology and biology, the clinic and the pathological anatomy of oesophagostomosis as well. The parasitological literature has not supplied us with details on the struc-

ture of *Oe. dentatum* population. Tarczyński 1955 paid attention for the first time to the population changes of that nematode by simultaneous infections with bacteria and viruses. A special character of that work, however, did not allow for a deeper penetration of the essence of the biocoenological problems.

The aim of the present work is therefore to explain the basic regularities of populations occurring in the course of *Oe. dentatum* invasion in clinically healthy hosts and to compare the population structures of that nematode in domestic swine with those in wild boars.

To trace the dependence of the population structure of *Oe. dentatum* on its numerousness in the clinically healthy hosts (domestic swine — *Sus scrofa domestica* L. and wild boar — *Sus scrofa* L.), 5,800 specimens of *Oe. dentatum* were examined, 2,338 of which were males and 3,462 females. The material was obtained during the postmortem examinations of 60 swine and 60 wild boars, finding out that in domestic swines the extensiveness of invasion was 75% (45 swine), whereas in wild boars 11.7% (7 wild boars). The age of all examined animals was more than 6 months.

With regard to the intensivity of the *Oe. dentatum* invasion which is usually strong, there were collected only those specimens which were found in the 20 cm. long section of intestine cut out from the middle part of the large intestine.

For the determination of the number of population the following scale was used:

0—50	specimens of <i>O. dentatum</i>	— a not numerous population (+);
51—100	„ „ „	— a fairly numerous population (++);
101—200	„ „ „	— a numerous population (+++);
above 201	„ „ „	— a very numerous population (++++).

Thus among 45 swine invaded with *Oe. dentatum* a not numerous population of that parasite was found in 11, fairly numerous in 14, numerous in 7, and a very numerous population in 13 swine; however, in 7 invaded wild boars there was found a not numerous population in 4 of them, fairly numerous in 2, and a very numerous population in 1 case.

Of special interest is the fact that a very numerous population of *Oe. dentatum* was found in one wild boar living in Zoo for years (The Zoo of Kraków).

Table I shows the percentage of the particular types of populations in the invaded hosts and in relation to the total number of the examined swine and wild boars. This table also shows the relation of sex of the parasites in populations of different numerousness. According to that comparison the sexual structure of the population of *Oe. dentatum* in swine changes gradually with the increase of its number; in wild boars there can be taken into account only the populations structures „+” and „++” and their picture can be considered as typical for the *Oe. dentatum* species. The data are illustrated by the Diagrams 1 and 2.

In order to obtain data as to the size of the *Oe. dentatum* specimens in the already described population groups in swine and in wild boars, there

were carried out measurements of the length and the maximal width of the body of 3648 specimens (1423 males and 2225 females); from that number 3207 specimens fall on the nematodes found in domestic swine, and 441 on those found in wild boars.

Table 1

Types of *Oe. dentatum* populations in swine and wild boars,
and sex structure of these populations

Type of population	Domestic swine (60)						Percent. of ♂♂
	No. of hosts	which makes		Parasites collected			
		total investiga- ted swine	invaded swine	total	♂♂	♀♀	
+	11	18	24	158	47	111	29.7
++	14	23	31	832	279	553	33.5
+++	7	12	16	1013	440	573	43.4
++++	13	22	29	3330	1413	1917	42.4
Wild boars (60)							
+	4	7	57	56	21	35	37.5
++	2	3	29	172	53	119	30.1
+++	-	-	-	-	-	-	-
++++	1	2	14	239	85	154	35.6

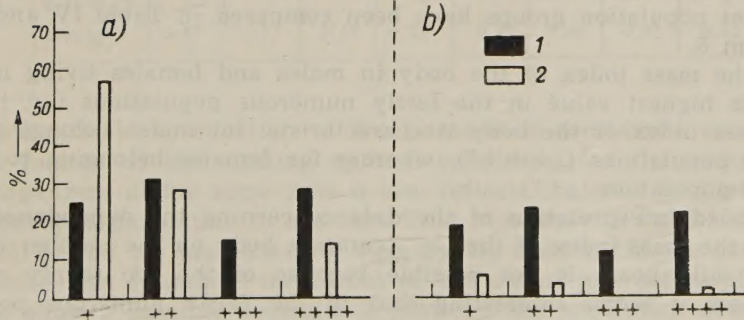


Diagram 1. Extensiveness of invasion of swine and wild boars with *Oe. dentatum* in relation to the numerosness of the population. a — in % of invaded animals;

b — in % of all examined animals

1 — in swine; 2 — in boars

The results of measurements of *Oe. dentatum* found in swine are illustrated by the comparison in Table II and by its corresponding Diagram 3. In Table II the dimensions of all examined specimens of *Oe. dentatum* in the particular population groups have been summed up.

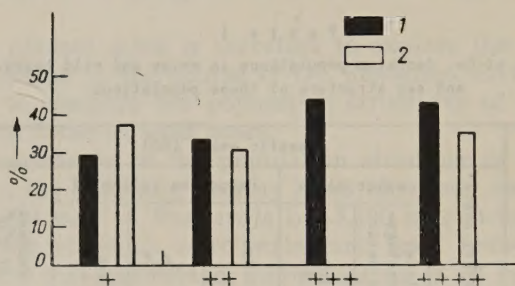


Diagram 2. Percentage of males in various population groups of *Oe. dentatum* in swine and wild boars

1 — in swine; 2 — in boars

The detailed average dimensions of *Oe. dentatum* in the particular populations have been shown in Diagram 4.

Analysing the above data it is worth noticing that the length and width of *Oe. dentatum* change in the particular population groups, whereby those changes are different for males and females. It can be generally admitted that the width of the body changes proportionally to its length. That principle is especially visible in reference to females in the examined populations (Diagram 4). In males, however, from the population „++” there could be observed a distinct increase of the average width of the body with a simultaneous, very slight decrease of the average length of the body (Diagram 4).

The average dimensions of the *Oe. dentatum* body for various populations from wild boars have been presented in Table III.

The product of the average group length of the body by the average group width of the body can be considered as the mass index (Mi) of the body of the examined nematodes. The values of that index for *Oe. dentatum* in different population groups have been compared in Table IV and shown in Diagram 5.

Thus the mass index of the body in males and females living in swine reaches its highest value in the fairly numerous populations („+++”). The lowest mass index of the body is characteristic for males belonging to the numerous populations („++++”), whereas for females belonging to the not numerous population („+”).

A detailed interpretation of the data concerning the dependence of the values of the mass index of the *Oe. dentatum* body on the number of population in wild boars is not possible because of the too scanty material. Nevertheless it seems interesting that in the fairly numerous population („+++”) the value of that index is distinctly smaller than in not numerous populations („+”), what in comparison with data concerning the sexual structure of those populations (Table I) allows to suppose that there exists certain biological regularity in that respect.

T a b l e I I
Measurements of *Oe. dentatum* from domestic swine

Length of body - mm	Males				Females			
	+	++	+++	++++	+	++	+++	++++
Total	46	173	305	751	109	325	417	1081
4-4.9			1					
5-5.9		2		2				
6-6.9	1	1	15	32			2	2
7-7.9	14	44	109	207	6		6	7
8-8.9	18	82	131	308	15	10	25	29
9-9.9	7	34	48	137	13	24	50	58
10-10.9	5	10	1	53	23	85	115	246
11-11.9	1			11	13	61	85	224
12-12.9				1	20	92	99	293
13-13.9					16	46	33	141
14-14.9					3	6	2	64
15-15.9								13
16-16.9								4
17-17.9						1		
Average	8.84	8.56	8.12	8.29	10.87	11.65	11.09	11.56
width of body - mm								
0.1-0.14			1					
0.15-0.19				2				
0.2-0.24	2	11	17	20				4
0.25-0.29	5	21	45	86		3	1	4
0.3-0.34	25	55	148	318	21	16	24	43
0.35-0.39	11	55	71	234	23	56	73	207
0.4-0.44	2	24	23	88	30	100	134	340
0.45-0.49	1	7		1	16	45	81	188
0.5-0.54				2	10	51	68	130
0.55-0.59					5	31	31	83
0.6-0.64					2	19	5	76
0.65-0.69						3		4
0.7-0.74						1		1
0.75-0.79								1
Average	0.32	0.37	0.32	0.32	0.41	0.46	0.43	0.42

The maximal reproduction of the parasite is considered as one of the distinct factors of the existing optimal conditions for the parasite in the host's organism; at the same time it also reflects the most profitable density of the parasite population in the host. That reproduction finds its expression above all in the big production of eggs by the females. In the present work there were also examined the faeces of 180 swine just before slaughtering them to show a possible dependence between the population density of *Oe. dentatum* and the number of eggs produced by females. For that purpose always the same quantities of faeces (5 g.) were taken from the pig rectum; afterwards the faeces were examined by the flotation method using saturated salt. Eggs were counted in 5 drops taken from the surface of the liquid

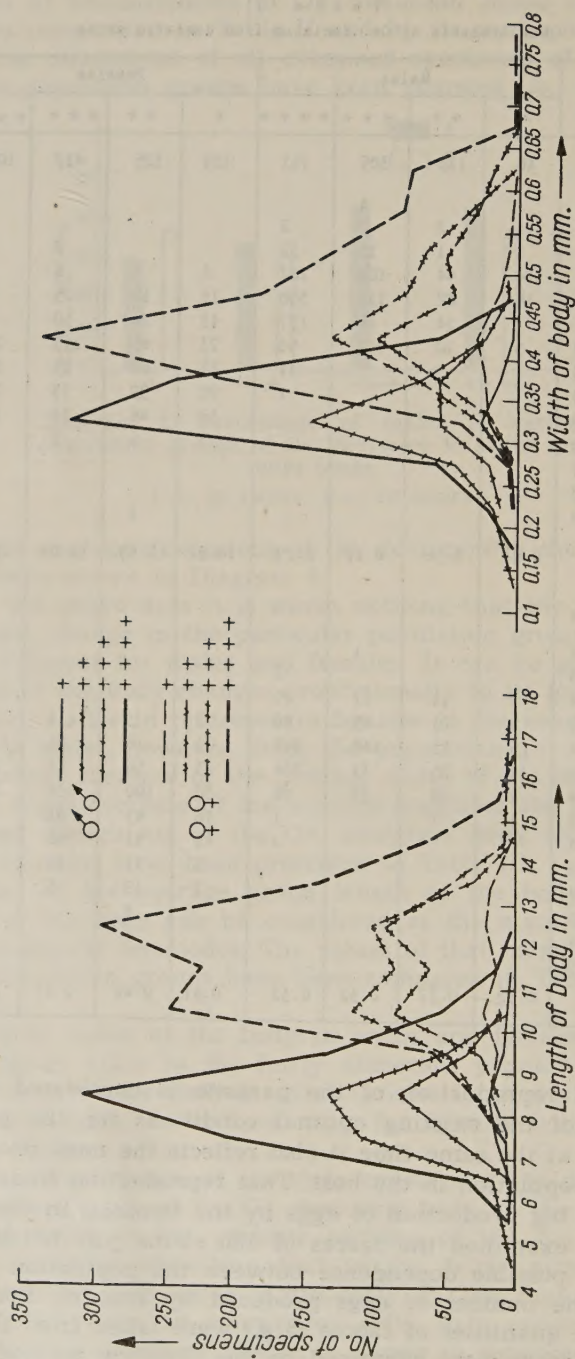


Diagram 3. Sizes of *Oe. dentatum* in various population groups in swine

suspension of faeces centrifugated in an electric centrifuge for 3 minutes at 800 r/min. The results of the calculations have been shown in Table V. The density of the parasite population was settled at the autopsy.

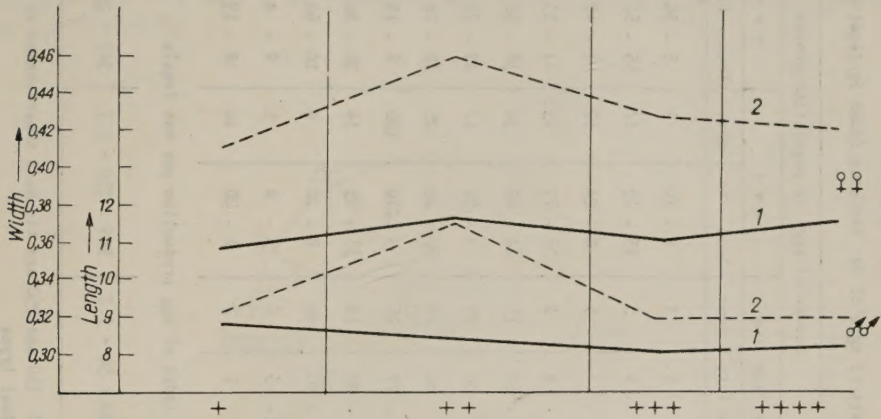


Diagram 4. Variability of average sizes of the body of *Oe. dentatum* in relation to the numerousness of populations in swine

1 — Mi of group body length; 2 — Mi of group body width

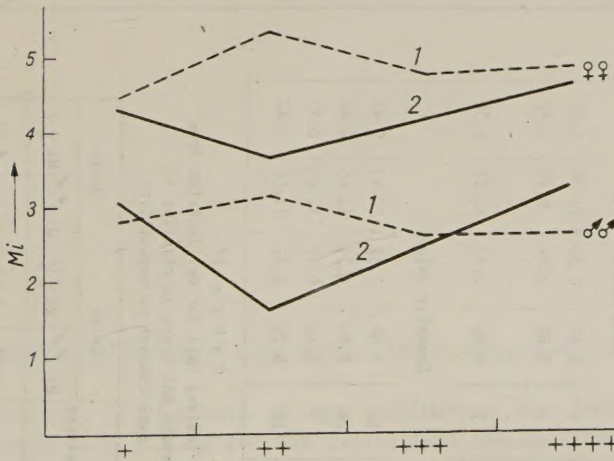


Diagram 5. Variability of mass index (Mi) in relation to the numerousness of populations of *Oe. dentatum* in swine and wild boars

1 — in swine; 2 — in boars

As it is visible in Table V the highest absolute values of the number of eggs found in faeces were proved in population groups „+++” and „++++”. However, the numbers of eggs found in groups „+” and „++” are relatively big what bears evidence of a considerable decrease of the rate of egg production by the *Oe. dentatum* females living in pigs in popu-

Table V
Mean numbers of eggs of *Oe. dentatum* found in fecal samples

Month	Number of eggs in population groups					
	+ and + +		+ + +		+ + + +	
	from - to	mean	from - to	mean	from - to	mean
I	0 - 5	3	8 - 10	9	5 - 36	20
II	1 - 4	3	15 - 19	17	55 - 62	59
III	3 - 7	5	0 - 24	12	1 - 42	19
IV	1 - 4	3	37 - 72	55	11 - 33	22
V	11 - 17	15	24 - 48	36	38 - 50	45
VI	5 - 30	20	5 - 30	17	12 - 70	48
VII	11 - 30	22	20 - 29	25	18 - 26	22
VIII	0 - 77	26	9 - 210	120	6 - 19	11
IX	18 - 20	19	33 - 35	34	28 - 30	29
X	0 - 80	40	8 - 10	9	10 - 60	34
XI	2 - 3	2	1 - 8	5	2 - 4	3
XII	0 - 2	2	3 - 20	10	18 - 19	15
Index of egg production per one female						
160 : 50 - 3.2						349 : 150 - 2.3
						347 : 250 - 1.4

* Numbers 50, 150 and 250 are the mean numerosness of population of individual types

Table III
Mean body measurements of *Oe. dentatum* in various populations from swine and wild boars

Populations		Males		Females	
type	number	length	width	length	width
Wild boars					
+	4	8.62	0.36	11.98	0.36
++	2	6.89	0.24	8.78	0.42
+++	-	-	-	-	-
++++	1	8.80	0.37	12.23	0.38
Domestic swine					
+	11	8.84	0.32	10.87	0.41
++	14	8.56	0.37	11.65	0.46
+++	7	8.12	0.32	11.09	0.43
++++	13	8.29	0.32	11.56	0.42

Table IV
Mass indices (Mi) for *Oe. dentatum* from swine and boars in relation to numerosness of populations

Populations	Swine		Boars	
	Mi ♂♂	Mi ♀♀	Mi ♂♂	Mi ♀♀
+	2.83	4.46	3.1	4.31
++	3.17	5.36	1.65	3.68
+++	2.60	4.77	-	-
++++	2.65	4.85	3.25	4.64

lations „+++” and in populations „++++” (see the egg production index for females from different populations — Table V). Thus, it must be admitted that the biggest individual egg production characterizes the females of *Oe. dentatum* living in pigs in not numerous („+”) and in fairly numerous populations („++”), but it is violently decreasing in very numerous populations („++++”).

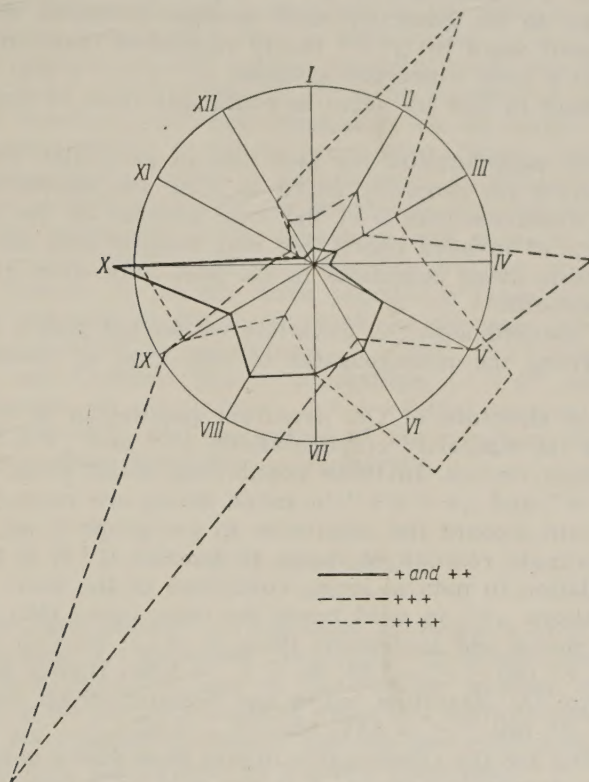


Diagram 6. Seasonal variability of eggs number of *Oe. dentatum* in the feces of swine

The examination of the rate of egg production was being carried out during the whole year taking for the calculation the material from 15 pigs per month (5 heads for every population group). It is evident from the data of Table V that the intensivity of egg production by the female of *Oe. dentatum* in population groups „+”, „++” and „+++” is increasing considerably in the warm season of the year. The highest number of the produced eggs for the groups „+” and „++” falls on the period from May to October, but for the group „+++” on the period from April to September. The regularities are not so distinct in the very numerous population group, but here too in the cooler season of the year from November to January the number of eggs decreases to minimum; its increase, however, already begins by distinct leaps in February (Diagram 6).

Results

1. The invasion with *Oe. dentatum* being found in 75% of examined domestic swine and only in 11.7% of wild boars has a distinct „breeding” character in Poland too.

2. This breeding character of oesophogostomosis confirms the occurrence of invasion with *Oe. dentatum* in all its degrees in domestic swine, whilst in wild boars we do not generally meet stronger invasions than those marked in the present work by „++” (fairly numerous invasions). In the investigated material a very numerous invasion („++++”) was found only in one wild boar kept in Zoo for years in conditions close to those of domestic swine.

3. Taking into consideration the fact that in particular living conditions of wild boars there are generally found in them not numerous („+”) invasions with *Oe. dentatum* (6.66% of the total number of the examined wild boars, and 57.1% of invaded boars), we may assume that this species finds its most favourable living conditions in the host body when it occurs in not numerous populations.

4. In swine invaded with *Oe. dentatum* we do not find a distinct predominance concerning the numerousness of any kind of invasion with that nematode.

5. The sexual structure of *Oe. dentatum* population in wild boars and swine points to the similarity of populations „+” and „++” in swine and wild boars in that respect. In those populations males form $\pm 30\%$. In populations „++++” and „++++” in swine males are more than 40% (Table I). Taking into account the conclusion in paragraph 3 we are to assume that the approximate relation of males to females (1:2) is typical for *Oe. dentatum* population in natural living conditions of the host.

6. In populations „+” in wild boars the mass index (Mi) reaches higher values both in males and in females ($Mi \text{ } \sigma \sigma = 3.1$; $Mi \text{ } \varphi \varphi = 4.31$) than in populations „++” ($Mi \text{ } \sigma \sigma = 1.65$; $Mi \text{ } \varphi \varphi = 3.68$). Higher Mi values, however, characterize *Oe. dentatum* males and females which live in swine in populations „++” ($Mi \text{ } \sigma \sigma = 3.17$; $Mi \text{ } \varphi \varphi = 5.36$).

Worth noticing are the considerably higher mass index values of *Oe. dentatum* in a very numerous population in the wild boar from Zoo. $Mi \text{ } \varphi \varphi = 4.64$ reached in this case a value approximate to indices characterizing those nematodes in populations „+++” and „++++” observed very often in swine (Table IV).

The mass-indices of female nematodes parasitizing wild boars are generally smaller than the mass-indices of female nematodes from swine. The mass-indices of males of populations „++++” and „+” are distinctly bigger for wild boars than for swine.

In the case of *Oe. dentatum* from wild boars in optimum populations „+” with regard to their reproduction, the average body-mass too reaches a higher value than in populations „++”. That mass is growing rapidly in the material from the wild boar kept in artificial conditions close to those of swine, in spite of the fact that nematodes occurred then in population „++++”. The fluctuations of body-mass of *Oe. dentatum* males dependent on the numerousness of population (from wild boar) are similar (Diagram 6).

7. The remarks in paragraphs 1—6 led to the opinion that the domestication of the host created new conditions suiting an invasion with *Oe. dentatum*. It allows us to conclude that there occurs a common invasion in swine, a general increase of the average body-mass of nematodes in population „— —”, and an increase of the number of males in populations „+ + +” and „+ + + +” (above 40%).

8. The observations on egg production by the females of *Oe. dentatum* in swine intestine have shown that in populations „+ + +” and „+ + + +” the particular females on the average produce much less eggs than in populations „+” and „+ +” (Table V). Thus the number of eggs produced by the particular females is not only dependent on the sexual structure of the population (paragraphs 5, 7), but on many other factors, probably above all those concerning feeding which is diametrically so different in breeding of domestic swine as compared with the natural living conditions of wild boars.

9. In the egg production of *Oe. dentatum* from swine in populations „+”, „+ +” and „+ + +” there can be noticed a distinct seasonal variability (Diagram 7). Namely, in all the three population types the egg production becomes more intensive in the warm season of the year, whereby the maximum of egg production in populations „+” and „+ +” falls on the period between May and October, and in populations „+ + +” on the time from April to September. In populations „+ + + +” that seasonal egg production is visible less distinctly, and the period of the minimum egg production is shortened to 3 months (November — January).

Discussion

In the book „The Ecology of Invasions by Animals and Plants” Elton introduces the term of ecological „explosion” to denote the reason of the phenomenon of a rapid increase of the parasite number of some species. That explosion is the result of slipping away of a definite species from under the control of the hampering factors, and the breaking of the chain of correlation conditioning the balance in a given biocoenosis.

The described in the present work biocoenological phenomena can be included to categories of processes called by Elton the „ecological explosion”. The domestication of the *Oe. dentatum* species (together with its host, swine), by shortening of the natural „feeding chains”, led to a rapid increase of its numerousness in domesticated hosts. That rapid increase of numerousness spoiled the natural population structure of the nematode, and destroyed the a long time established unsteady balance between the host (wild boar) and the parasite. It led to fatal consequences for the host, being very often manifested by a disease and always by a distinct stopping of weight increase in swine. Thus, the domestication of swine increased the pathogenicity of the parasite which lost that pathogenicity in a fairly high degree in its proper free-living host in the time of a long coexistence.

Wiśniewski 1955, suggesting the introduction of the new term „the parasite capacity of the host”, maintains that the decrease of the parasite pathogeny comes from the creation of conditions limiting the mass of pa-

parasites in the organism of the host. An invasion with *Oe. dentatum* seems to confirm to a certain degree this conception. If the parasite in swine lives in numerous and very numerous populations it produces distinct pathological reactions. It can be explained by the fact that the „parasite capacity” of swine which has been established evolutionally on the level of not numerous („+”) or fairly numerous invasions („++”), did not increase according to domestication in that degree in which the host domestication improved the living conditions for the parasite.

The above observations are closely connected with bioecological observations of other authors, and particularly with the results of the experimental works carried out by Pavlovskij et Gnezdilov 1951, 1953 on monospecific populations of *Diphylllobothrium latum*. Those authors expressed their opinion that in homogeneous populations of intestinal parasites the population tends to preserve life of the species not on the way of struggle for the existence among the individuals but by stopping the growth and development of the particular nematodes forming that population. The structure of such populations results in the following:

(a) the average dimensions and mass of the particular nematodes are inversely proportional to the number of the population members, and the general population size (the sum of lengths and masses of all members) is proportional to their number;

(b) the more numerous the tapeworm population is, the more of its members are stopped in further development, so that only a small number of specimens gets bigger sizes.

In connection with Pavlovskij's et Gnezdilov's observations there arises a question whether the regularities concerning tapeworms can be also generalized for the nematode populations. The *Oe. dentatum* population can be treated as monospecific populations because in the large intestine was found only that nematode or only very few simultaneous invasions with other nematodes, mainly *Trichocephalus trichiurus*. In the increasing *Oe. dentatum* populations (as to their number) in swine the values of the average body length show a tendency to decrease proportionally to the increase of the population number in population groups from „+” to „+++”. The width of the male body, however, is something increasing in populations „++”, and is on the same level in the remaining population groups. In females both the length and width of the body increase in population „++” but then the width of the body shows a tendency to decrease its value with the progressing increase of the population number. The length of the female body, decreasing distinctly in population group „+++”, increases then considerably in very numerous populations (Table II and Diagram 3 and 4).

In wild boars the length and width of male body are decreasing distinctly in populations „+-”. The length of the female body behaves similarly, whereas the width of their body increases in populations „++” (Table III).

The indices of the body mass point to a distinct increase of the average body mass of *Oe. dentatum* in fairly numerous populations from swine, whilst the average body mass of nematodes from wild boars is decreasing distinctly in the same conditions (Diagram 5). Because of the single case of invasion with *Oe. dentatum* population „++++” in the wild boar it cannot be treat-

ed equally with the cases of other invasions and therefore it was omitted in the above considerations.

The scantiness of material from wild boars does not allow to draw any clear conclusions. It seems, however, that the observations in the present work allow to settle a general rule as to the formation of population structures (given by Pavlovskij et Gnezdilov) concerning *Oe. dentatum* as well, but only in the case of natural formation of populations in free-living hosts. When the host gets under the influence of new environment factors created by the breeder (e. g. change of feeding) than the natural regularities get shattered. It refers both to the dimensions and mass of the particular nematodes and to the sexual structure of population. In the artificial breeding of hosts the population structure undergoes some changes in the direction of a steady mass increase not only of the whole population but of the particular members as well. That phenomenon concerns the females of the parasite in particular. Thus, in that concrete case the host domestication appeared favourable especially for the parasite. Owing to those new conditions there grows, above all, the parasite mass, there grows the absolute number of the reproduction elements, there undergoes some change the unsteady balance, fixed a long time ago between the parasite and host. The „domesticated” parasite becomes more pathogenic.

The second rule of Pavlovskij et Gnezdilov, telling us about the contents of immature forms in populations, could not be checked in details on the material used in my investigations. Such checking would require the acception of other principle and other method of investigation.

The described results of investigations on the populations of *Oe. dentatum* in swine and wild boars have shown a distinct influence of domestication of the host on the parasite organism and on the structure of its population. This influence, i. e., the effect of the environment of the first order and indirectly that of the second order is enormous and leads to the creation of new ecological, morphological and physiological properties. On the other hand the observations on the reproduction of that nematode and particularly on the egg production point to the commonly known in nature conservatism of live organisms. In spite of such deep changes, *Oe. dentatum* in a great majority of cases shows distinct, seasonal fluctuations of intensivity in egg production. The maximum of egg production, found in the present work, which falls on the warm season of the year, is of great importance in the epizootic process occurring in free nature. In conditions of breeding those fluctuations lost their significance, but still they occur till now distinctly.

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STRESZCZENIE

W wyniku przeprowadzonych badań nad strukturą populacji *Oe. dentatum* u 60 świń domowych i 60 dzików ustalono że:

1. „Hodowlany” charakter ezofagostomozy (75% świń dotkniętych inwazją wobec 11,7% dzików) potwierdza występowanie inwazji *Oe. dentatum* we wszystkich stopniach intensywności, podczas gdy u dzików nie spotyka się na ogół inwazji silniejszych niż oznaczonych w tej pracy symbolem „+++”;

2. Wydaje się, że w naturalnych warunkach bytowania żywiciela (dziki) *Oe. dentatum* znajduje najlepsze warunki w organizmie żywicielskim bytując w nim w populacjach nielicznych „+”;

3. Stwierdzono podobieństwo struktur płciowych populacji „+” i „+++” u świń i dzików, w których stosunek samców do samic przedstawia się w przybliżeniu jak 1:2 i wydaje się być typowy dla populacji *Oe. dentatum* w naturalnych warunkach bytowania żywiciela; w populacjach liczniejszych „++++” i „+++++” u świń samce stanowią $\pm 75\%$ samic;

4. Wskaźniki masy ciała (M_i = średnia dł. ciała $\times$ średnia maks. szer. ciała) samic z dzików są na ogół mniejsze od takich wskaźników dla nicieni zebranych od świń; M_i samców z populacji „++++” i „+” są wyraźnie większe dla nicieni z dzików, od wartości tych wskaźników dla *Oe. dentatum* ze świń domowych; w optymalnych warunkach bytowania u dzików (populacje „+”) samice *Oe. dentatum* osiągają przeciętną masę ciała wyższą niż w populacjach „+++”; masa ciała samic wzrasta gwałtownie u dzika chowanego w warunkach zbliżonych do hodowli trzody chlewnej, mimo że wtedy nicienie wystąpiły w bardzo licznej populacji „+++++”;

5. Powyższe uwagi pozwalają sądzić, że udomowienie żywiciela stworzyło nowe, sprzyjające warunki dla inwazji *Oe. dentatum* (powszechność inwazji u świń domowych, ogólne zwiększenie przeciętnej masy ciała nicieni w populacjach „+++” u udomowionych żywicieli, zwiększenie liczby samców w populacjach „++++” i „+++++”);

6. W populacjach „++++” i „+++++” poszczególne samice pasożytujące u świń produkują przeciętnie znacznie mniej jaj niż w populacjach „+” i „+++”, co przemawia za wnioskiem, że produkcja jaj zależy nie tylko od płciowej struktury populacji, ale i od innych, najprawdopodobniej w tym przypadku żywieniowych czynników;

7. Obserwuje się wyraźną sezonową zmienność produkcji jaj przez samice *Oe. dentatum* bytujące u świń w populacjach „+”, „+++” i „++++”;

8. Opisane zjawiska biocenologiczne mieszczą się w kategorii procesów biologicznych ujmowanych przez Elton'a pod mianem „eksplozji ekologicznej”, potwierdzają w pewnym względzie koncepcję Wiśniewskiego, dotyczącą tzw. „pojemności żywiciela na pasożyty”, a także wydają się potwierdzać możliwość uogólnienia zasady powstawania struktur populacyjnych (Pavlovskij, Gnezdilov) również i na nicienie *Oe. dentatum*, jedynie jednak w przypadku naturalnego formowania się populacji u wolnożyjących żywicieli.

